

## **Environmental monitoring of the decommissioning radioactive waste storage: A.L.A.R.A., Estonia**

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A.L.A.R.A. Ltd is radioactive waste management agency in Estonia. The A.L.A.R.A. Ltd was established 1995 to manage and decommission of the former nuclear submarine training center at the northern part of Estonia in the Paldiski city and the "RADON" type Low Level Waste (LLW) storage facility at the Tammiku village. The main activities A.L.A.R.A. is working with are, (1) decommissioning of former nuclear submarine training center at Paldiski (Paldiski object) and LLW storage facility at Tammiku village (Tammiku object), (2) managing an interim storage for low and intermediate radioactive waste from the year 1997 at Paldiski site, (3) environmental monitoring program of Paldiski and Tammiku objects, (4) radioactive waste management and transport, and (5) starting with surveys to establish final storage for radioactive waste in Estonia.

Former nuclear submarine training center is located in the Pakri peninsula in Northern Estonia. There is an interim storage for low and intermediate level radioactive waste and two closed nuclear reactors where the nuclear fuel was unloaded and the reactors were sealed in 1995 by the Russian Federation. In the same year A.L.A.R.A. took the Paldiski facility over from Russian Federation and started with decommissioning the buildings. However, reactors lying in the steel-concrete shelters have put to wait until 2040, before they are safe for the final decommissioning.

The LLW storage facility at Tammiku was commissioned in 1963. The facility was designed in accordance with the USSR standard type of so called "Radon" facilities, and was primary storage facility for radioactive waste generated from use of radionuclides in Estonia. Waste from different sources: from medical, science, and other institutions, as well as from military aircraft were dumped in the facility. High-level radioactive waste is together with very low-level radioactive waste, and mixed with nonradioactive and chemical waste. The facility was closed 1995. However, the Environmental Impact Assessment and several international studies have proven that the storage facility does not correspond to the present safe management requirements. Area around the storage facility was not properly covered with and the conditions of the waste were unknown due the poor documentation history. The A.L.A.R.A. has renovated storage cover and developed safety systems. Decommissioning of Tammiku LLW facility started at 2008 and project is planned to end 2013. After that the site will remain

under environmental monitoring. The waste is identified, sorted, characterized, conditioned, and transported to the interim storage at the Paldiski site.

Environmental monitoring of the Paldiski and Tammiku sites consists of groundwater, wastewater, soil, grass, and general gamma ray measurements. We analyze  $H^3$ ,  $Sr^{90}$ ,  $Cs^{137}$ , and  $Co^{60}$  nuclides four times per year from ground- and wastewater and  $Sr^{90}$ ,  $Cs^{137}$ ,  $Co^{60}$  four times per year from grass and soil. Statistical analysis shows that results are going lower or are stable during the decommission works.